

(12) UK Patent Application (19) GB (11) 2 296 632 (13) A

(43) Date of A Publication 03.07.1996

(21) Application No 9526689.6

(22) Date of Filing 29.12.1995

(30) Priority Data

(31) 4447243

(32) 30.12.1994

(33) DE

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(51) INT CL⁶

H04Q 7/38

(52) UK CL (Edition O)

H4L LDSH L1H10 L1H3

(56) Documents Cited

EP 0509548 A2

(58) Field of Search

UK CL (Edition N) H4L LDSH

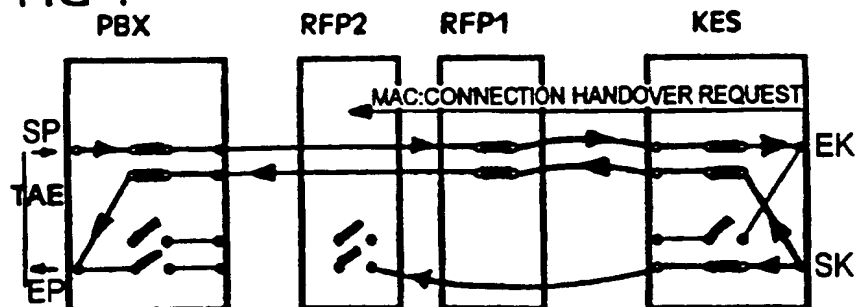
INT CL⁶ H04Q 7/38

ONLINE; WPI, INSPEC

(54) Handoff Method for Cordless Telephone System

(57) Method for carrying out connection hand over caused by a cordless device in Dect systems with modified standard: after signalling of the exchange set up request signal "connection hand over request" the mobile part also immediately transmits the useful data in the newly formed channel. Therefore in the exchange node after reception of the "connection HO request" forwarded from the newly selected base station the reception can be immediately switched over to this (without a gap in the useful data transfer). In the transmission direction the exchange device can transmit in parallel via both base stations until, for instance, an acknowledgement of the new base station is received via the error-free signal transmission of "bearer confirm" or until the mobile part releases the existing connection.

FIG 1



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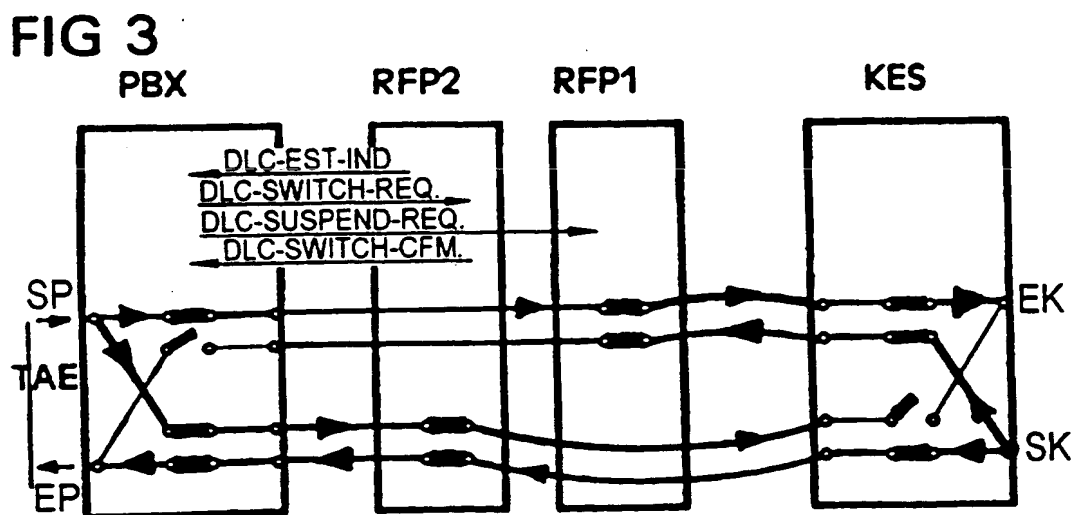
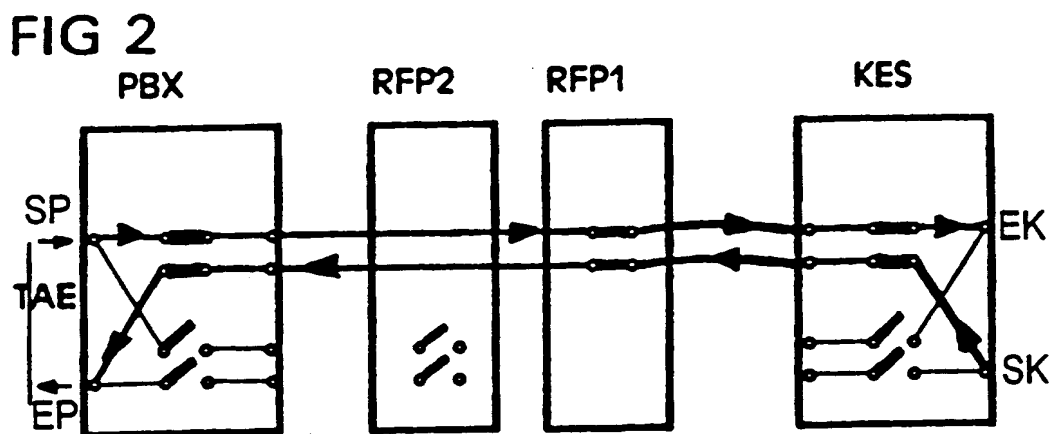
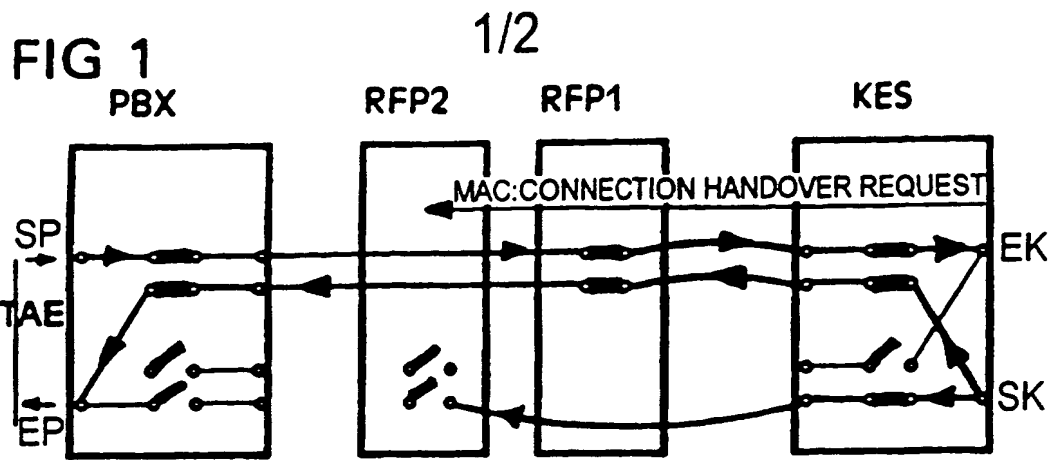


FIG 4

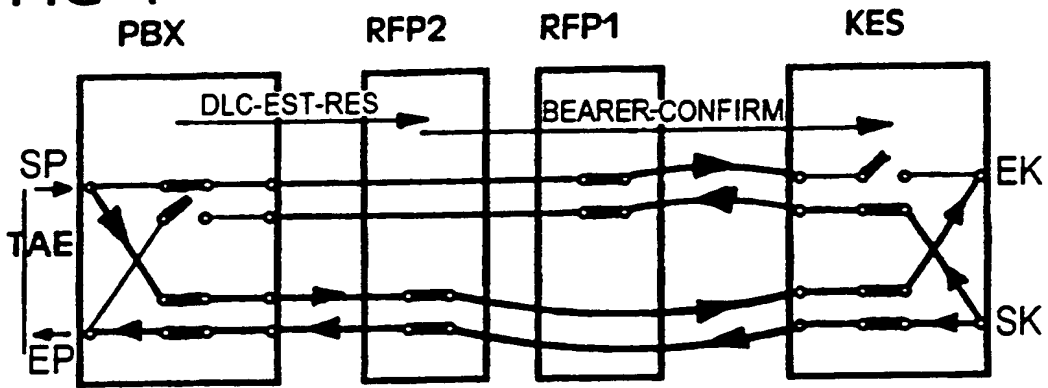


FIG 5

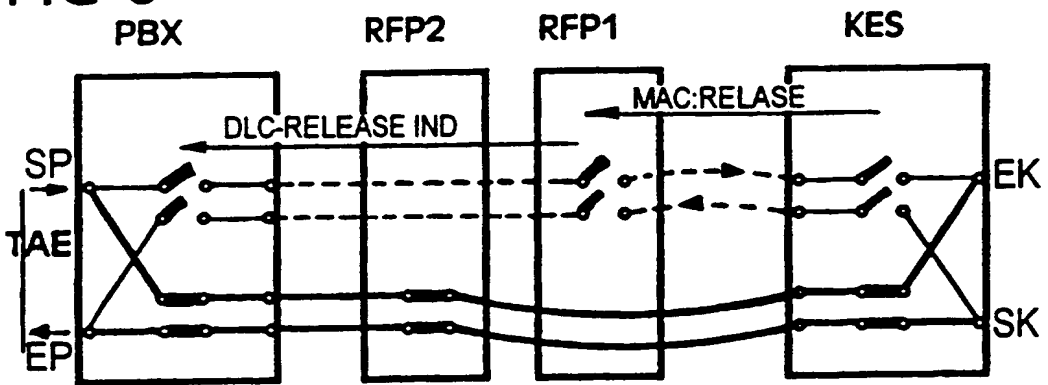
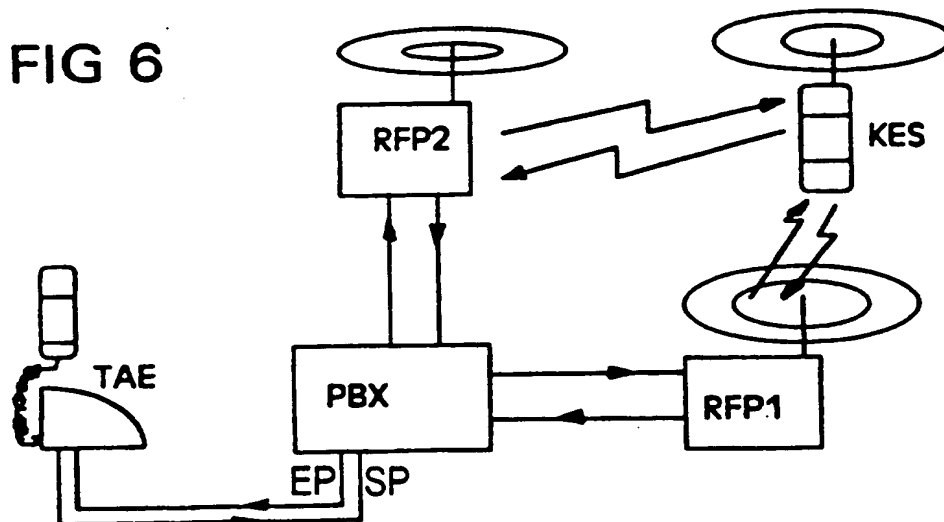


FIG 6



Method for connection control in communication systems
with wire-less signal transmission

The invention relates to a method for clearing a
5 connection existing between a cordless terminal and
an exchange device through a first base station, and
for simultaneously establishing a connection between
this cordless terminal and the exchange device
10 through a second base station, in other words the
passing-on of an existing connection from a first to a
second base station. What is meant by this passing-on
is the so-called "connection handover" in the DECT
Standard ETS 300 175-1 to ETS 300 175-11, in particular
15 in ETS 300 175-4:1992, chapter 9.2.7.3, defined in
ETSI.

Such procedures are carried out in communication
systems having at least one exchange device for
clearing and establishing connections between
20 communication terminals, wherein useful information
within a connection can be transferred in the form of
useful signals between the exchange device and a
communication terminal, and the exchange device in turn
can receive and transmit useful signals which can be
25 transferred by wire. In such communication systems
there is respectively provided a plurality of base
stations connected to the exchange device in order to
convert wire-transferrable useful signals into wire-
less transferrable useful signals in order to
30 distribute these useful signals in one of several
selectable channels and to convert wire-less
transferrable useful signals into wire-transferrable
useful signals. The base stations, so-called lt. DECT
"Radio Fixed Part" (RFP), thus make possible the
35 setting-up of connections between communication
terminals, also called the mobile part, which receive

and transmit wire-less signals and are constructed as a cordless terminal (KES), and the exchange device.

The above-mentioned DECT standard provides for a
5 cordless terminal (mobile part) connected by means of a
first base station to the exchange device to transmit
an exchange set up request signal ("Connection Hand
Over Request") to a second base station to produce the
setting-up of a connection between this mobile part and
10 the exchange device by means of this second base
station. The mobile part has to make the lt. DECT
standard B-channel data available, in order to transmit
useful signals to the second base station, as soon as
it has received a "bearer confirm" signal from this
15 base station. At this moment B-channel data is also
available from the exchange device by means of this
base station. Directly after receipt of the "bearer
confirm" signal the mobile part has to switch receipt
over to the second base station because it is stated in
20 the DECT standard that after error-free transfer of the
"bearer confirm" signal on the system side the existing
connection can be cleared, and in fact this must be
done without signal-type release at the air
intersection between the base station and the mobile
25 part (ETS 300 175-4:1992, chapter 9.2.7.3). With a
standard connection handover the existing connection,
according to the definition, is released from the
mobile part.

30 Whilst it is stated in the DECT standard that responses
to signalling between mobile parts and base stations
are guaranteed within about five milliseconds via the
air intersection, the corresponding response times
between base stations and exchange nodes are normally
35 ten to a hundred times longer. Accordingly, there is
no exact information in the exchange node as regards

the instant at which a base station selected for a new connection transmits the "bearer confirm" message to the relevant mobile part or when this mobile part receives said message. The selection of the instant
5 when the useful data reception is to be switched over from the existing base station to the new base station in the case of "connection handover" in the exchange device is therefore problematic.

10 If, immediately after the exchange device initiates the parallel transmission of useful data to both participating base stations, the receipt of useful data in the exchange device is switched over to the new base station, useful data may still not be available to the
15 mobile part via the new base station. On the other hand, if the exchange device does not switch the useful data reception over to the said new base station until after it has received an acknowledgement of the new base station via the error-free transmission of the
20 "bearer confirm" message, then the mobile part may already have ended the transmission of useful information. This will be because of the longer wire transferred signalling duration via the original base station and as a result of reacting to "bearer confirm"
25 before receipt of the acknowledgement message in the exchange device and hence a specific time before the exchange-side switchover of receipt.

In the two cases described a gap appears within the
30 useful data transfer. If the useful data are speech signals then the non-traceable exchange path changeover from one base station to the next ("seamless handover") described in the DECT standard is not guaranteed. With data transfer certain data sequences are omitted during
35 connection handover so that corresponding communication devices can only be used for data transfer if they

include some form of expensive error-monitoring system.

An embodiment of the present invention may provide a process which guarantees the clearing and establishing
5 of a connection between a mobile part and an exchange device by means of various base stations without the loss of useful data in the manner described above.

According to the invention there is thus provided a
10 method of clearing a connection existing between a cordless terminal and an exchange device via a first base station and for simultaneously establishing a connection between this cordless terminal and the exchange device via a second base station - called
15 "connection handover" in ETS 300 175-4:1992, chapter 9.2.7.3 - in a communication system having at least one exchange device for establishing and clearing connections between communication terminals, wherein useful information within a connection can be
20 transfered in the form of information-bearing signals between the exchange device and a communication terminal, and the exchange device can receive and transmit information-bearing signals which can be transferred by wire; and
25 a plurality of base stations connected to the exchange device to convert wire-transferrable information-bearing signals into wire-less transferrable information-bearing signals and to distribute these signals in one of several selectable channels and to
30 convert wire-less transferrable information-bearing signals into wire-transferrable signals in order to make possible a connection between a cordless communication terminal adapted for receiving and transmitting wire-less signals, and the exchange
35 device; wherein a cordless terminal, connected via the first base station to the exchange device, transmits an

exchange set up request signal
(ConnectionHandoverRequest) to the second base station
to establish a connection between this cordless
terminal and the exchange device via this second base
5 station, the cordless terminal transmits information-
bearing signals in parallel via data channels to the
first base station and to the second base station after
transmission of the exchange set up request signal
(Connection HandoverRequest), irrespective of any
10 subsequent receipt of a following acknowledgement
signal.

Preferred embodiments of the invention are the object
of the sub-claims.

15 According to the invention the mobile part initiating
the clearing and establishing of connections transmits
the useful data in the newly laid channel as well as
the old channel in the period immediately after
20 signalling the exchange set up request signal
"connection hand over request".

This means that, after receipt of the exchange set up
request signal "connection HO request" forwarded from
25 the newly selected base station in the exchange nodes,
the receiving device can immediately be switched over
to this base station without a gap being able to appear
in the useful data transfer. In the transmission
direction the exchange device can transmit in parallel
30 via both base stations until, for instance, an
acknowledgement from the new base station is received
by means of the error-free signal transmission of
"bearer confirm" or until the mobile part releases the
existing connection.

35 For a better understanding of the invention and to show

how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings, in which:-

- 5 Figures 1 to 5 in the sequence Figure 2, Figure 1, Figure 3, Figure 4 and Figure 5, show different states of the B-channel, during and after a "connection handover" procedure and, in layer 2, the
10 signalling which has preceded the respective state (according to the OSI layer model) and
Figure 6 an arrangement for carrying out a communication process.
- 15 Figures 1 to 5 show the block diagram of an arrangement consisting of a PBX exchange device, a first base station RFP1 (from the English expression Radio Fixed Part), a second base station RFP2, a cordless terminal
20 KES and a subscriber terminal unit TAE provided at the PBX exchange device. Figure 2 shows the B-channel initial state, namely that a B-channel is connected in the transmission direction from a connection SP, for the transmission signal being transferred from a
25 subscriber terminal unit TAE, via the first base station RFP1 through to a connection EK preparing the received signal for further processing in the cordless terminal KES. It also shows that a B-channel is connected through from the transmission connection SK
30 in the cordless terminal KES via the first base station RFP1, and the exchange device PBX is connected through to a terminal EP preparing the receiving signal for the subscriber terminal unit TAE. To initiate a process according to the invention, as shown in Figure 1, the
35 signalling message "connection handover request" is transferred from the cordless terminal KES in the MAC

layer (from the English expression medium access control) to the second base station RFP2. This has the same effect as a request of the cordless terminal KES to the second base station RFP2 for assignment of a
5 radio channel. Furthermore, a useful channel connection to the second base station RFP2 is established by the connection SK of the cordless terminal KES so that the information prepared, at the connection SK, by the cordless terminal, is transmitted
10 in parallel to the first base station RFP1 and to the second base station RFP2.

As can be seen in Figure 3, the second base station RFP2 transfers the request DLC-Est-ind for assignment
15 of a new channel as a signalling message to the exchange device PBX. The exchange device PBX then communicates by means of the signalling message DLC-Switch-req to the second base station RFP2 that it can connect the useful channel connection through in
20 both directions. The second base station RFP2 confirms with the message DLC-Switch-cfm, to the exchange device PCBX, that it has connected the useful channels through in both directions. As can be seen in the bottom half of Figure 3, after the transfer and acknowledgement of
25 the above messages, a useful channel connection exists from the exchange device PBX to the cordless terminal KES via the first base station RFP1 and so does a useful channel connection from the cordless terminal KES to the exchange device PBX via the second base
30 station RFP2. The connection from the first base station RFP1 to the receiving terminal EP of the subscriber terminal unit TAE is no longer connected inside the exchange device PBX. Accordingly at this moment the reception for the terminal EP of the
35 subscriber terminal unit TAE in the exchange device PBX is switched over from the first base station RFP1 to

the second base station RFP2.

As can be seen in Figure 4, the exchange device PBX then transfers to the second base station RFP2 a state
5 acknowledgement message DLC-Est-res in order to confirm that reception in the exchange device PBX has been switched over to the second base station RFP2. Then the second base station RFP2 in the MAC layer transfers an acknowledgement message "bearer confirm"
10 to the cordless terminal KES and thus confirms that the second base station RFP2 is available for connection to the exchange device PBX.

In accordance with the DECT standard, directly after
15 reception of the acknowledgement signal "bearer confirm" transmitted from the second base station RFP2, the cordless terminal KES switches over the reception-side connection from the first base station RFP1 to the second base station RFP2. Figure 4 shows this state,
20 in which the useful channel connection is effected via the second base station RFP2, both in the transmission and the reception direction.

Then, as can be seen in Figure 5, the cordless terminal
25 KES transfers the signal message release in the MAC layer to the first base station RFP1 so as to cause release of the connection from the cordless terminal KES to the first base station RFP1. To release the connection between the first base station RFP1 and the
30 exchange device PBX the first base station RFP1 transfers a signalling message "DLC-release-ind" to the exchange device PBX. As shown in the bottom half of Figure 5, the connection, in both directions, between the exchange device PBX, the first base station RFP1
35 and the cordless terminal KES is released. The useful channel state in Figure 5 thus corresponds to the state

shown in Figure 2, but instead of a connection via the first base station RFP1, it shows a connection via the second base station RFP2.

- 5 Figure 6 shows schematically the bi-directional connection possibilities between an exchange device PBX, which can be switched by wire with two base stations RFP1 and RFP2 and with a subscriber terminal unit TAE. In the example of Figure 6, conventional
- 10 telephone equipment is shown as the subscriber terminal unit TAE. Of course a different communication device such as, for instance, a facsimile device, a data terminal or the like or a cordless device can also be connected instead of conventional telephone equipment.
- 15 As can also be seen from Figure 6, a bi-directional wire-less connection can be provided either between the cordless terminal KES and the first base station RFP1 or between the cordless terminal KES and the second base station RFP2.

Claims

1. Method for clearing a connection existing between a cordless terminal and an exchange device via a first base station and for simultaneously establishing a connection between this cordless terminal and the exchange device via a second base station - called "connection handover" in ETS 300 175-4:1992, chapter 9.2.7.3 - in a communication system having
- 10 - at least one exchange device for establishing and clearing connections between communication terminals, wherein useful information within a connection can be transferred in the form of information-bearing signals between the exchange device and a communication terminal, and the exchange device can receive and transmit information-bearing signals which can be transferred by wire; and
 - 20 - a plurality of base stations connected to the exchange device to convert wire-transferrable information-bearing signals into wire-less transferrable information-bearing signals and to distribute these signals in one of several selectable channels and to convert wire-less transferrable information-bearing signals into wire-transferrable signals in order to make possible a connection between a cordless communication terminal adapted for receiving and transmitting wire-less signals, and the exchange device;
- 30 wherein a cordless terminal, connected via the first base station to the exchange device, transmits an exchange set up request signal to the second base station to establish a connection between this cordless terminal and the exchange device via this second base station, the cordless terminal then transmitting
- 35

information-bearing signals in parallel via data channels to the first base station and to the second base station after transmission of the exchange set up request signal irrespective of any subsequent receipt
5 of a following acknowledgement signal.

2. Method according to claim 1, wherein
- after receipt of the exchange set up request signal the second base station transmits a
10 corresponding message to the exchange device,
 - the exchange device then transmits information-bearing signals in parallel via data channels to the first base station and to the second base station and, on the exchange-side, reception is
15 switched over from the connection via the first base station to the connection via the second base station,
 - then on the terminal side reception from the connection via the first base station is switched
20 over to the connection via the second base station and the cordless terminal ends the parallel transmission,
 - the exchange device ends the parallel transmission, and
 - 25 - the connection via the first base station is cleared.

3. Method according to claim 1 or 2, wherein after parallel transmission from the cordless terminal to the
30 first and the second base station the second base station converts the received information-bearing signals and transmits them to the exchange device, and wherein switch-over of reception in the exchange device is then effected.

35

4. Method according to claim 1, 2 or 3, wherein after

receipt of an acknowledgement message from the second base station the cordless terminal switches over reception from the connection via the first base station to the connection via the second base station.

5

5. Method according to claim 4, wherein the acknowledgement message is transmitted after the exchange-side switch-over of reception from the exchange device to the cordless terminal.

10

6. A method of clearing a connection between a cordless terminal and an exchange device via a first base station whilst establishing the connection via a second base station substantially as hereinbefore

15 described with reference to the accompanying drawings.

13

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
 GB 9526689.6

Relevant Technical Fields

- (i) UK Cl (Ed.N) H4L (LDSH)
 (ii) Int Cl (Ed.6) H04Q 7/38

Search Examiner
 MR N HALL

Date of completion of Search
 5 MARCH 1996

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
 1-6

(ii) ONLINE: WPI, INSPEC

Categories of documents

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Category	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0509548 A2 (NEC) see column 7, lines 7-49	1, 3-5
X	CH 682867 A5 (ASCOM)	1

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